Updating the ESE Research Strategy

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Principles for Updating Research Strategy

- Must clearly reflect NASA mission and vision, including "As only NASA can"
- Must be done in a time frame that will feed into development of Enterprise and Agency Strategic Plans
- Desire is for "evolution, not revolution" - likely maintain present framework but reflect changes in
  - State of Science
  - Internal agency and external federal context (esp. CCRI)
- Need to maximize community involvement in the process to build its sense of ownership of product; ESSAAC can take lead on behalf of community

Scope of Update to ESE Research Strategy

- Maintain Basic Structure, including top and first level questions
- Look at 23 second tier questions for possible changes:
  - Update based on changes since plan was last set
    - Scientific advances in understanding and availability of new data
    - Recent geophysical events or results that require explanation
    - Expected technological advances in plan period that may enable new areas of study
  - Update based on changes in external (agency, interagency) environment
    - New NASA visions and mission, including “One NASA” and “to protect”
    - Existence of CCRI, new focus on delivering products to policy and decision makers, and assessments of change, vulnerability, and resilience
    - Increased focus on transition of systematic observations to operational agencies and acceleration of results from research to operations
    - Desire to connect to longer-term (10-25 year time frame) horizon

Scope of Update to ESE Research Strategy, cont.

- Nature of Changes to Questions
  - Modifying wording (e.g., expansion or contraction of scope)
  - Adding, removing, or combining questions
  - Reordering of questions within a family
- Review Observational Parameters Identified in Tables
  - Balance Between Systematic and Exploratory
  - Transition from Research to Operations
- Consider if Other Tables are Needed (e.g., predictions)

First Step: Look at the Questions

- Consider to what extent question list needs to be changed, recognizing basic philosophy of
  - "evolution, not revolution"
  - avoidance of "question proliferation"
  - maintaining NASA focus.
- Solicited input of changes and possible new questions, shared with ESSAAC members identified to help with assessment, and encouraged to present strawman list for discussion/modification.
- Once questions are clear, can focus on document revision and creation of new and revised text.

Variability

- ***How is the global Earth system changing? [Current]***
  - How are global precipitation, evaporation, and the cycling of water changing?
  - How is the global ocean circulation varying on interannual, decadal, and longer time scales?
  - How are global ecosystems changing?
  - How is stratospheric ozone changing as the abundance of ozone-destroying chemicals decreases and new substitutes increases?
  - What changes are occurring in the mass of the Earth's ice cover?
  - What are the motions of the Earth and the Earth's interior, and what information can be inferred about Earth's internal processes**?**

- ***How is the global Earth system changing? [Suggested New]***
  - How are global precipitation, evaporation, and the cycling of water changing?
  - How is the global ocean circulation varying on interannual, decadal, and longer time scales?
  - How are global ecosystems changing?
  - How is atmospheric ozone changing as the abundance of chemically active source gases increases?
  - What changes are occurring in the mass of the Earth's ice cover?
  - What are the motions of the Earth and the Earth's interior, and what information can be inferred about Earth's internal processes**?**

Forcing

- ***What are the primary forcings of the Earth system? [Current]***
  - What trends in atmospheric constituents and solar radiation are driving global climate?
  - What changes are occurring in global land cover and land use, and what are their causes?
  - How is the Earth's surface being transformed and how can such information be used to predict future changes?

- ***What are the primary forcings of the Earth system? [Suggested New]***
  - What trends in atmospheric constituents and solar radiation are driving global climate?
  - What changes are occurring in global land cover and land use, and what are their causes?
  - How is the Earth's surface being transformed?

Response

- ***How does the Earth system respond to natural and human-induced changes? [Current]***
  - What are the effects of clouds and surface hydrologic processes on Earth's climate?
  - How do ecosystems respond to and affect global environmental change and the carbon cycle?
  - How can climate variations induce changes in the global ocean circulation?
  - How do stratospheric trace constituents respond to change in climate and atmospheric composition?
  - How is global sea level affected by climate change?
  - What are the effects of regional pollution on the global atmosphere, and the effects of global chemical and climate changes on regional air quality?

- ***How does the Earth system respond to natural and human-induced changes? [Suggested New]***
  - What are the effects of clouds and surface hydrologic processes on Earth's climate?
  - How do ecosystems and biogeochemical cycles respond to and affect global environmental change?
  - How can climate variations induce changes in the global ocean circulation?
  - How do atmospheric trace constituents respond to change in climate and atmospheric composition?
  - How is global sea level affected by climate change and natural variability in the Earth system?

Consequence

- ***What are the consequences of change in the Earth system for human civilization? [Current]***
  - How are variations in local weather, precipitation and water resources related to global climate variation?
  - What are the consequences of land cover and land use change for the sustainability of ecosystems and economic productivity?
  - What are the consequences of climate and sea level changes and increased human activities on coastal regions?

- ***What are the consequences of change in the Earth system for human civilization? [Suggested New]***
  - How are variations in local weather, precipitation and water resources related to global climate variation?
  - What are the consequences of land cover and land use change for human societies and the sustainability of ecosystems?
  - What are the consequences of climate change and increased human activities on coastal regions?
  - What are the effects of global chemical and climate changes on regional air quality?

Prediction

- ***How well can we predict future changes in the Earth system? [Current]***
  - How can weather forecast duration and reliability be improved by new space-based observations, data assimilation, and modeling?
  - How well can transient climate variations be understood and predicted?
  - How well can long-term climatic trends be assessed or predicted?
  - How well can future atmospheric chemical impacts on ozone and climate be predicted?
  - How well can cycling of carbon through the Earth system be modeled, and how reliable are predictions of future atmospheric concentrations of carbon dioxide and methane by these models?

- ***How well can we predict future changes in the Earth system? [Suggested New]***
  - How can weather forecast duration and reliability be improved by new space-based observations, data assimilation, and modeling?
  - How can predictions of transient and long-term climate variations be improved through use of new space-based observations, data assimilation, and modeling?
  - How well can future atmospheric chemical impacts on ozone and climate be predicted?
  - How will carbon cycle dynamics change in the future?
  - What will be the future regimes of precipitation, soil moisture, and other hydrologic variables under a variety of climate conditions or transient climate anomalies?
  - How can predictions for transformations of the Earth surface be improved through the use of space-based observations?
  - How will terrestrial and marine ecosystems and land cover change on time scales from years to centuries?